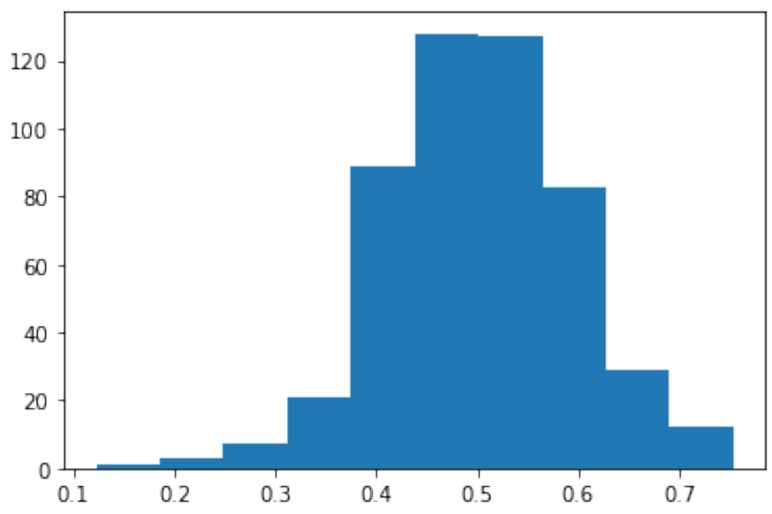
In [8]:
```
#import the possibly necessary packages
import numpy as np
import random
import math
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:
```
#The following creates the necessary data points. DO NOT CHANGE ANYTHING
#HERE
#########################################################
rng = np.random.default_rng()
r=1/2+0.1*rng.normal(size=550)
i=0
r1=np.zeros(500)
for j in range(550):
    if i<500:
        if r[j]<1 and r[j]>0:
            r1[i]=r[j]
            i=i+1
            swim=r1
#########################################################
#Start your work here. The location of each swimmer is in the 'swim'
#vector.
```

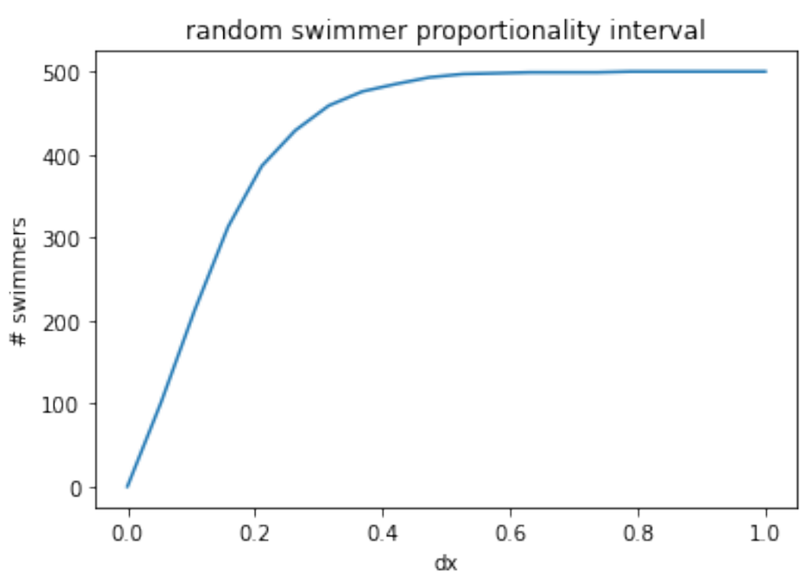
In [5]:
```
plt.hist(swim)
```

Out[5]:
```
(array([  1.,   3.,   7.,  21.,  89., 128., 127.,  83.,  29.,  12.]),
 array([0.12254777, 0.18568013, 0.24881248, 0.31194484, 0.37507719,
        0.43820955, 0.5013419 , 0.56447426, 0.62760661, 0.69073897,
        0.75387133]),
 <BarContainer object of 10 artists>)
```



In [10]:
```
swimmers_count=np.array([((0.5-dx/2<swim)&(swim<0.5+dx/2)).sum() for dx in np.linspace(0,1,20)])
```

In [13]:
```
sns.lineplot(y=swimmers_count,x=np.linspace(0,1,20))
plt.xlabel("dx")
plt.ylabel("# swimmers")
plt.title('random swimmer proportionality interval')
plt.savefig('random swimmer proportionality interval')
```



In [14]:
```
swimmers_count_2=np.array([((0.5-dx/2<swim)&(swim<0.5+dx/2)).sum() for dx in np.linspace(0.01,0.2,200)])
```

In [15]:
```
np.polyfit(np.linspace(0.01,0.2,200),swimmers_count_2,1)
```

Out[15]:
```
array([1924.36370778,    3.35681068])
```

In [ ]:
```

```